

Chapter 12

The Theory of Survival

Much of my work at the Naval Radiological Defense Laboratory (NRDL) was analytical in nature despite my stories of close encounters with the nuclear monster at CROSSROADS, CASTLE, and other nuclear weapons tests. By “analytical,” I mean studying other people’s research, comparing various data, and staring at the wall while thinking deep thoughts. Most often, such wall-staring occurred in the process of searching for a “theory of survival.”

From the very beginning of the Nuclear Age, the question of survival was crucial. The destruction of Hiroshima and Nagasaki by atomic bombs shocked the entire world—even though the horrific fire bombings of Tokyo, Hamburg and Dresden had caused greater destruction and loss of life. Somehow, the atomic bomb was clearly different. It was “one bomb, one city” on the radio and in the newspapers. In 1946, the distinguished naval historian and strategist, Professor Bernard Brodie, entitled his book, *The Absolute Weapon*. Another book of the time was *No Place to Hide*. For those like myself who were in the atomic defense business, you can see we had a problem.

There were some glimmerings of hope. In Japan, the United States Strategic Bombing Survey, led by Paul Nitze, was finding a lot of survival in concrete buildings in Hiroshima and Nagasaki. People in a tunnel right under the bomb at Hiroshima survived uninjured even though there was no door at the entrance. All in all, the report of the Strategic Bombing Survey did not support the idea that the atomic bomb was an absolute weapon that rendered war obsolete.

I was recruited into the search for a theory of survival almost the moment I arrived at NRDL in the fall of 1948. I was assigned to produce *Radiological Defense, Volume II*, the story of which I have told in an earlier chapter. The purpose of RDII, as we called it, was told in its subtitle, *The Principles of Military Defense against Atomic Weapons*. The trouble was that no principles of defense—no theory of survival—had been promulgated.

So, I took a stab at it. Looking back at the effort, I realize that we were lucky to be working for the military services rather than a civilian agency. While the military had a large number of sizable bases, they were like islands in a civilian sea. We were located at the San Francisco Naval Shipyard. Forty miles down the Peninsula was Moffatt Naval Air Station. Forty miles north was an Air Force base. Across the Bay was Alameda NAS and the Oakland Army Base. Our audience was the command structure of bases like these. We were led naturally to thinking about the nature of this target system and thus to a cellular concept of organization in which these military bases were cells or units separated from each other but adjacent to civilian cells, such as cities, counties, or big industrial facilities.

This cellular view of the target became fundamental to our defense plan. In an atomic attack, some cells would be destroyed or heavily damaged. Some would suffer lesser

damage. Some would be beyond the reach of damage. The latter should be able to send emergency forces to help. When they encountered evidence of damage or fallout radiation, they were to set up a control point and a casualty treatment station. Fire and rescue teams would penetrate further into the damaged area until barred by fire or a high radiation level. Thus, two perimeters would come into being: a control perimeter and a fire/rescue perimeter. If the civil cells were trained the same way, there would be a multitude of cells, each prepared for self-help and for mobile aid.

Back then, around 1950, nuclear weapons were small as we know them now and they were few and expensive. But this two-perimeter defense based on a cellular organization had some very good characteristics. It did not assume where the explosion might occur. It did not assume only one bomb detonation. It did not assume the size of the enemy weapon. The emergency response would be driven by readily observable events as they occurred. It could, of course, be overwhelmed by an attack by numerous weapons or huge weapons because it was an “outside-in” concept—it assumed that undamaged cells were not too far away to provide help.

The Navy Passive Defense Plan

We got the essence of this operational concept into RDII although Sam Glasstone blue-penciled a good part of it. But our time was soon to come. It came in the form of a review draft of a document prepared somewhere in the office of the Chief of Naval Operations and titled *Navy Passive Defense Plan*. The plan had been sent to NRDL for comment and rather quickly found its way to my desk for response. Perhaps one of the reasons no one else volunteered to respond was that the plan was in the form of a classical military operations plan of five paragraphs—although each “paragraph” was many pages long. It looked quite foreign to most of the nerds in the Scientific Department.

The problem with the classical military operations plan format was that it presumed that the reader (and user) had been trained in the “nuts and bolts” of the operations being planned. But that was not the case when the operations concerned defense against nuclear attack. For that reason, the plan seemed to talk all around the subject. There was no “theory of survival.” There was no substantive concept of operations. This was no great surprise to me. I had seen the civil defense plan for the city of San Francisco, also in the classical military operations planning format, and it suffered from the same deficiency. Both plans spelled out in great detail what subordinate organizations were involved, who reported to whom, and how they would be supported logistically and by communications. But when it came to describing what was to be done, both plans were a little like Admiral Nelson’s famed “England expects every man to do his duty.”

I discussed the problem with Dick Laurino and Fred Goshe. We saw a great opportunity to put some meat on the bare bones of the Navy plan but we needed to be adroit in the manner of doing so. There was an inclination to dump the classical format and start over. I felt that such an approach was bound to fail. The CNO people would be outraged and our CO, realizing this, might not even sign off on the result, no matter how good it was. The solution surfaced when I noticed that detailed lists and other supporting information

were usually relegated to “annexes” to the plan. One of the plan paragraphs was titled, “Concept of Operations.” Rather than substitute our concept for the CNO version, which actually said very little, I added a sentence referring to an annex for details. We wrote the annex our way.

Actually, we did rather more to the review draft than just to add annexes. The essence of the two-perimeter defense based on a cellular organization crept into the body of the plan. For example, the basic organizational idea was that each naval base would prepare not only to shelter and protect its own personnel but also would organize fire and rescue forces to help others if the base was not itself attacked. However, naval bases and stations came in all sizes. The smaller units would not be able to man the rescue forces. So we applied the full concept only to bases above a certain size. In general, if a base were large enough to have its own fire department, it was large enough. And, throughout the plan there was an unstated assumption that all military bases as well as large industrial plants and municipalities would be cells in a compatible system.

I hand-carried the review response to the head shed and discussed it with the CO. He approved and off it went. For a long time I heard nothing about it. Then, on October 15, 1957, I was called to the office of Captain McQuilken, who was then CO. To my surprise, DeeJay was there, along with the other top brass. She hadn’t told me that morning that she would be coming to the Lab. Captain McQuilken made a little speech and then pinned a medal on me. He read the following:

DISTINGUISHED CIVILIAN SERVICE AWARD to Mr. Walmer E. Strobe for services set forth in the following CITATION: Through his outstanding leadership and personal efforts Mr. Strobe has made contributions of an important and far-reaching nature in the field of atomic and nuclear defense. His work in developing new concepts in the field of countermeasures, specifically in conjunction with the protection of military and civilian populations during nuclear warfare, and the ensuing period of rehabilitation within radiologically contaminated areas, is widely recognized and has been of incalculable value to the Navy and the Nation. Mr. Strobe’s concept of the Navy’s role in atomic defense was recommended to the Chief of Naval Operations and adopted as the basis for the present Navy Passive Defense Plan. By virtue of his extraordinary achievements in developing, defining, and presenting these new concepts, Mr. Strobe is richly deserving of the Navy’s highest civilian service award.

Needless to say, I was flabbergasted and pleased out of my skull.

The Countermeasure System

The immediate response to a nuclear attack: warning, shelter, firefighting, rescue, radiation detection and all that was the focus of our early search for a theory of survival. I summarized it all in a major NRDL report, USNRDL-450, "Passive Defense Philosophy and Principles of Damage Control in Atomic Attack on Shore Establishments", issued in September 1954. Note that the subject is couched in Navy lingo even though the principles were appropriate not only to the military but also to civil defense.

There was another limitation as well. The immediate response to attack was not the whole of nuclear defense because of the lingering threat of radiation from fallout. Starting in 1950, one of our major study projects was about decontamination in fallout areas. We published "Current Status of Countermeasures against Radiological Contamination from an Atomic Detonation" in July of 1951. Soon after this, we were asked to develop a training manual for the Bureau of Yards and Docks. This manual, "Radiological Recovery of Fixed Military Installations", published in 1953, was also adopted by the Army and the Air Force. At the time, there was no connection between this work and the cellular system of damage control. That disconnect bothered me.

My analysts and I kicked the problem around for some time. Gradually we realized that we were dealing with distinct operational phases. The two-perimeter defense dealt with what we came to call "the emergency phase." The radiological recovery aspect dealt with the aftermath, which we first called "the recovery phase." The latter phase did not survive our critique. It was too vague and open-ended. It did not discriminate between the urgent need to use military facilities to fight a war (and the urgent need to restore water and power to civilian areas) and the much longer-term need to control radiation exposure to the population. Accordingly, we divided the recovery phase into two phases: the "operational recovery phase" and the "final recovery phase."

Thinking in terms of time-phases turned out to be important because what one did (or didn't do) in the emergency phase had an effect on the subsequent phases, especially with respect to radiation exposure. If the people needed for operational recovery were not given good shelters in the emergency phase, recovery would be delayed or workers would be overexposed. In other words, a good understanding of the needs of operational recovery was essential in emergency planning.

By 1952, I had developed a lecture that I used whenever I had the opportunity and especially at the damage control course at the naval base at Treasure Island in San Francisco Bay. I don't have a copy now but it went something like this: Consider the heaviest fallout area from an atomic weapon, an area experiencing 3,000 R at one hour after burst. (This was before the hydrogen bomb with yields so large that fallout did not arrive until many hours after burst.) The total unprotected exposure over several years would be about 15,000 R in this peak fallout area. Of the total "infinite" exposure, about 10,000 R would be received in the first two weeks. This dose would kill people many times over as the lethal dose was considered to be about 500 to 600 R.

A shelter with a “protection factor” of 10 (allowing an exposure to 1/10 the unprotected exposure) would not be enough because 1,000 R (10,000 R divided by 10) would still be lethal. A shelter with a protection factor of 100 would allow an exposure of 100 R, which is not lethal but is near the level where some people would be sick. Fine, except that these people still had to face the threat of exposure to 5,000 R (15,000 R minus 10,000 R) after being sheltered for the first two weeks. Reclamation workers would be too vulnerable to additional exposure. Better to have shelters with a protection factor (PF) of 1,000, which would allow only 10 R at the end of two weeks, a negligible burden to carry into the operational recovery phase.

So I argued that shelters ought to have a PF of 1,000. I still hold that shelters built for the purpose should meet that criterion, which means underground shelters generally. But later, when I joined the Office of Civil Defense in the Pentagon, we were searching for shelter in existing buildings having a PF of 100 and later a PF of 40. Why? How could I subscribe to such criteria? Simple. First, very little PF 1,000 shelter was to be found in existing buildings. Second, the people doing the operational recovery work did not have to come from the peak fallout area if the operational plans were on a cellular basis because cells with low exposure during the first week or two could perform the reclamation work in the peak fallout area.

The time phasing thus was important. One accepted less than perfect fallout protection in the emergency phase in return for greatly improved area-wide operations in the operational recovery phase. Eventually, in February 1956, this approach was finally published as USNRDL-TR-74, “Radiological Defense Measures as a Countermeasure System.” It, of course, did not contain all the later developments but it was the start of a practical theory of survival.

TR-74, the countermeasure system report, contained another idea that proved to be important. It was the concept of a “central countermeasure.” As I analyzed each phase of the countermeasure system, I became unhappy with the “laundry list” of countermeasures that could be employed. Some of them were clearly more valuable than others, either through intrinsic high effectiveness or broad range of application to possible attack scenarios. I found that shelter stood out in the emergency phase and decontamination in the operational recovery phase. Exposure control seemed the most important in the final recovery phase. The central countermeasure concept played a major role in defining the countermeasure system.

The Seven Deadly Sins

I have mentioned earlier on that my two-perimeter defense system based on a cellular organization had some desirable characteristics: It did not assume a target of attack nor the number or size of weapons, for example. Actually, I identified seven assumptions pertaining to the attack circumstances that ought to be avoided in a good civil defense plan. These were (1) the size of the nuclear explosions, (2) the type of burst (air or surface), (3) the number of bursts, (4) where the burst(s) might occur, (5) the time of attack, (6) whether there would be warning of attack, and (7) the existence of central

control. A civil defense plan that made no assumptions of this nature would be flexible enough to apply to the range of situations that the area might encounter. I included these seven “no-nos” in USNRDL-450, published in September 1954.

I got an audience response when I showed a slide of the seven attack assumptions to a group of local civil defense directors. So I spotlighted them the next time by calling them “The Seven Deadly Sins of Civil Defense Planning.” It went over big. Then someone sent me a copy of FCDA publication AG-8-1. It was entitled, “Principles of Civil Defense Operations” and had been published in July, 1951, more than three years before I published USNRDL-450. Curious, I opened the pamphlet and was shocked to find an illustration that looked a lot like my two-perimeter defense system. Had I been scooped by FCDA? I was shaken. The publication date was about the time we were working on RDII. How come we had never heard of it? Perhaps for the same reason FCDA had never heard of us. I was being introduced to the barriers to communication between different agencies of the Federal Government.

I began to read publication AG-8-1. FCDA called their system a “web” defense, perhaps referring to a spider web. They illustrated the system by applying it to an unnamed urban area, which I recognized as Detroit, Michigan. They began by assuming the enemy would aim at downtown Detroit. That became the center of their web. Then they divided the urban area into pie-shaped slices that became their “cells.” (There are a dozen or so independent cities in the Detroit urban area. One radial boundary cut Hamtramck right in two.) When the publication began to lay out circular perimeters using convenient streets and highways, I realized that the FCDA web defense was committing every one of my “Seven Deadly Sins of Civil Defense Planning!”

No wonder that my civil defense audiences were chuckling over my presentation. I wondered whether FCDA had retracted the pamphlet in the face of my report and the Navy Passive Defense Plan. There was no indication that they had.

Chet Holifield Arrives

I was so far “out of the loop” that not only was I ignorant of FCDA official publications but also I had never heard of Chet Holifield until Herb Roback came to see us at the radlab on May 25, 1956. Roback was director of investigations for the House Military Operations Subcommittee, which was chaired by Chet Holifield, a Democratic congressman from southern California. Captain Hinnens, Paul Tompkins and I met with Roback in the CO’s office. The subject was civil defense. Because of the topic, I did most of the talking for the laboratory.

Herbert Roback was a short, well-built man about my age with a disconcerting stare that I later learned was due to an immovable glass eye on one side of his face. He explained that the House Government Operations Committee exercised the Congress’ oversight of Executive Branch agencies by means of a number of subcommittees, of which the Military Operations Subcommittee was one. The subcommittee had been engaged in an extensive set of hearings on civil defense brought on by a bill referred to the committee

that would establish a new Department of Civil Defense within the Department of Defense. The hearings had started the past January in Washington DC and had continued intermittently ever since, including hearings in various cities. The subcommittee was just then holding a two-day hearing in San Francisco, from which Roback was taking a brief recess. He was checking us out because Congressman Holifield recalled voting for a \$6 million laboratory building for the Navy here and Chief of Naval Operations Arleigh Burke had testified some months ago during which we were mentioned.

Captain Hinnners and Paul Tompkins handed the ball over to me after some pro forma remarks. Whereupon I laid out for Herb Roback our “theory of survival.” I had barely started when there was a gleam in his eye, the one that was looking at me, and he started asking questions in a clipped sort of voice. It was obvious that he liked what he heard. Several years later I obtained a bound two-volume copy of these 1956 hearings, all 3,145 pages of them, and I then understood what excited him. He and his boss, Chet Holifield, had been listening for five months to mayors, governors, generals, scientists, and civil defense officials, none of whom had any concept of a theory of survival. After my brief “dog and pony” show, Roback explained that the hearings would continue in Los Angeles the following Monday for several days, during which it would be essential that we make a presentation to the subcommittee. Well, one does not refuse to testify before a congressional committee, so the following Thursday the three of us appeared in the Los Angeles Police Department Auditorium, which Representative Holifield had commandeered.

The auditorium was very large and there was a goodly crowd assembled when we got there. As witnesses, we were seated in the front row by the guard at the door. Representative Holifield, a white-haired, somewhat portly gentleman, and one other subcommittee member sat on a dais behind a long bench. With them were several staff members, including Herb Roback. A witness table stood out in the area between the audience and the dais. Somewhere else in the front row was William L. White, whom I did not know at the time but with whom I became close in later years. He was there representing Stanford Research Institute, an organization in Menlo Park south of San Francisco, which had obtained a civil defense planning contract from FCDA. He testified after we had done our thing and left, so I did not find out what they were actually doing.

The day began with Dr. Stafford Warren, distinguished dean of the school of medicine at UCLA, on the stand. He was the head of the radsafe operation based on *USS Haven* during Operation Crossroads (see my Chapter 6). Dr. Warren was followed by Dr. Frank Schade, regional chief of medical organizations for civil defense in California. Their testimony took up the entire morning. The one thing I learned out of all that testimony was that Chet Holifield had also been on the *Haven* at Crossroads as a member of the congressional observer group.

After lunch, we were called to the witness table. Captain Hinnners, as CO and Director of NRDL, led off with a prepared statement that cited the mission to conduct research on hazardous nuclear and thermal radiation and associated effects of atomic explosions or other nuclear processes and “prepare data for planning purposes required by the military

services, including assistance to other Federal agencies.” He then described the laboratory facilities and its 600-person staff. Next, he said, “We regard passive defense after nuclear attack as consisting of three time-phases of action” and launched into my countermeasure system paper as the NRDL position. He described the idea of a central countermeasure and identified shelter as the central countermeasure in the emergency phase and reclamation in the operational recovery phase. Finally, he submitted my TR-74 for the record. All during his presentation, Herb Roback, sitting next to Chet Holifield, kept interjecting questions in his flat, prosecutorial tone of voice. Did it make any sense to divide responsibility between agencies for these phases? Wouldn’t it be wasteful to conduct civil defense effort without this system approach? It became clear to us that Roback and Holifield were strongly critical of FCDA’s performance of its mission.

When Captain Hinnners finished his statement, the questions really got pointed. It is a fact, is it not, that the mission of your laboratory is not necessarily limited to specific Naval functions? Yes. Your laboratory comprehends the whole field of atomic defense, does it not? Yes. Do you know of any agency of government that comprehends the functions you perform? No. To what extent do you overlap or duplicate the work of the AEC laboratories? Hinnners explained that the AEC was concerned with the safety of workers in nuclear production facilities and turned to me. I added something to the effect that our job was to devise ways of getting the mission accomplished under wartime conditions. Now that I had opened my mouth, Roback turned his attention to me.

“Now, you are the head, Mr. Strobe, of the military evaluations group. Is there any other agency in the Department of Defense or outside that makes such evaluations?” I noted that my field was known as operations research and there were numerous OR groups but Roback wouldn’t buy that. “Operations research in radiological defense?” No, we’re it. “Now, I would like to get an evaluation of the relationship of radiological defense to civil defense. I mean, aren’t those almost synonymous problems?” Well, pretty much so. “Are you aware that the FCDA has made a contract with the University of California to study this area?” My face must have been blank because Captain Hinnners answered yes. It seemed that an FCDA person had visited the lab earlier in the year when I happened to be away. I hadn’t known about it.

Roback bored in on Hinnners. “You were not consulted in any manner before the letting of that contract?” No. “You have not seen the articles, the terms of reference, or the scope of the contract?” No, said Hinnners. Whereupon Roback told us that the first item in the contract was a “comprehensive determination, review and analysis of the present status of radiological defense and its relation to overall civil defense and weapons development.” Wow! That contract was to do what we had already done, I thought. There were other items in the contract and Roback led us through them all one by one. It was clear that Roback and Holifield felt we should be doing that work and they blamed FCDA for ignoring us. It was also clear that the committee was looking for ways to pillory FCDA. I was being introduced to Washington politics. Eisenhower was president and his administration was Republican. The Congress was Democratic and FCDA was fair game. Even if FCDA had a good excuse (and it turned out that they had been turned down by the Pentagon on using us), Holifield still would have been critical.

Shortly, the fuss about the California contract subsided and, at Captain Hinnners request, I was next to testify. Since he had presented the three-phased countermeasure system detailed in TR-74, I started with the concept of a cellular emergency organization covered in my USNRDL-450 and incorporated in the Navy's passive defense manual. I emphasized how military bases and neighboring municipalities would be cells in this organization operating under a common plan of operations. I introduced the seven deadly sins of civil defense planning and showed how FCDA's AG-8-1 had committed all of them. This ignited another spate of anti-FCDA ire. Mr. Holifield asked whether the FCDA document dated 1951 had ever been recalled. I indicated that we had never received a notice of recall. We then explored the differences between what I called a weapon-oriented approach to planning (represented by FCDA's AG-8-1) and a target-oriented approach (represented by the Navy's passive defense plan.) This led to discussion of missile aiming errors and the need to be able to respond to a wide variety of attack scenarios. Finally, I showed how the original "outside-in" concept of emergency operations could gracefully move to an "inside-out" approach from shelters if the size and number of nuclear explosions made the outside too far away to be depended upon for help.

Paul Tompkins followed me with a fine summary of other laboratory work on the effects of fallout on agriculture and industry. About 3:30 in the afternoon we were finished and hurried off to catch a plane back home. We felt we had made a good impression but we really didn't realize how much of an impact we had made. When the Holifield committee published its report of the hearings, it devoted five pages to our theory of survival, prefacing it all with the following:

"It is not the subcommittee's function to lay down a blueprint for civil defense. Nevertheless it is necessary to draw attention to the fact that the Federal Civil Defense Administration has not yet begun to grasp fully the technical, administrative, or economic requirements of an effective civil-defense program. The technical planning requirements were outlined to the subcommittee in a penetrating and incisive analysis by representatives of the Naval Radiological Defense Laboratory. The observations of this section are based on that analysis, except that the subcommittee makes its own interpretations and conclusions."

But that was not all. Holifield held two more hearings in the 1950s and I was asked to testify and help the committee staff behind the scenes. Roback, with whom I became quite friendly, also pressured FCDA and the AEC to fund my work.

The Gaither Panel

Shortly after we had testified before the Holifield Committee, I left for Eniwetak to participate in Operation Redwing, a series of thermonuclear shots in which NRDL had several experiments. I served in a managerial role and the only thing I remember about that trip is that I spent the Fourth of July not far from where I spent July 4th just ten years before during Operation Crossroads. Upon my return to the radlab, I became involved in

the detailed design of the shelter described in Chapter 16. It was an underground version of the standard Navy ammunition storage magazine, outfitted to hold 100 people. I could visualize thousands of these shelters dug in around the nation. Actually, FCDA, which had responsibility for this sort of thing, was preparing to propose a national shelter program to the White House. The plan would build 35-psi blast shelters in the large metropolitan areas and provide fallout shelter elsewhere.

The briefing for President Eisenhower occurred on December 16, 1956. The briefer was Gerald “Pat” Gallagher, a distinguished looking gentleman who was Assistant Administrator for Engineering Research and Development and whose job I took some five years later. John Devaney, who actually developed the shelter plan and who later worked for me, flipped the charts for Pat. It is not true that Ike fell asleep during the briefing. It was a professional briefing, as good as any the ex-general had given in his day. According to John Devaney, Ike took copious notes. At its end, the President opened his mouth to ask a question. He was interrupted by his national security advisor, Bobby Cutler, who suggested he withhold any questions until a briefing on active defense was heard. The interruption apparently was abrupt. Ike’s face turned red, he threw down his pencil, and stormed out of the room. Nevertheless, the President later issued an order to his scientific advisor to organize an in-depth study of the alternatives for defense of the population against the threat of nuclear attack. The resulting study group, known as the Gaither Panel, met during the summer and fall of 1957 and I was a member of that study group.

My contributions to the report to the President by the Gaither Panel were negligible. I went to Washington for a week or ten days at a time in late July and August of 1957 as a member of the passive defense group, one of four working groups formed for the study. Dr. James Perkins of the Carnegie Corporation was the leader of the passive defense group and I met quite often with him. I never met any other of the members of the steering committee and I never saw the final report, which was delivered to the President on November 7, 1957, three weeks after the Soviet Union launched the “sputnik,” the first earth satellite.

The Gaither Report was classified Secret and was never released by President Eisenhower. In 1973, the year I retired from government service, the report was declassified and was published by the Joint Committee on Defense Production. In the appendix on Passive Defense I found the following:

“The Panel has considered passive defense as a two-pronged program: (1) shelters and (2) survival in the aftermath of nuclear attack. Each aspect is interdependent with the other; and every shelter proposal must be examined in the context of the postattack environment to see if, after varying conditions of attack, the sheltered population might reasonably expect to emerge into a situation permitting survival and recuperation.”

I like to think that paragraph was based on my concept of a phased system of radiological defense.

The real innovation in this study, however, was the consequence of the developing computer technology. Large computations, “number crunching” as it was called, were becoming practical. The computer machines were huge and because they used hot vacuum tubes had to be housed in air-conditioned rooms. We had one, a Burroughs, at NRDL. The data was input on IBM punched cards and the machines operated by trained programmers, but calculations that would take years using a mechanical calculator were now possible.

What happened was that FCDA, belying Chet Holifield’s allegations of incompetence, had contracted with Stanford Research Institute (SRI) to produce a computer program modeling a nationwide nuclear attack. Using census data and assumptions as to the vulnerability of the population, the program could add up the number of fatalities from a large nuclear attack. An interagency study group had done just that following FCDA’s shelter proposal to President Eisenhower, reporting the results for several shelter programs to the National Security Council on July 1, 1957, just as the Gaither Panel was getting started. Nothing would deter the passive defense group from doing its own calculations, using the SRI attack assessment procedure.

Attacks ranged from one of 3,000 megatons aimed at military targets to one of 7,000 megatons aimed at cities. For a mid-range attack of 4,000 megatons aimed both at cities and military bases, it was calculated that 115 million of a total of 200 million would be killed if unprotected. A nationwide fallout shelter program would save about half, leaving 55 million dead. Adding 30-psi blast shelters in urban areas reduced the death toll to 27 million. 100-psi shelters and 500-psi shelters would further reduce the loss of life, but not very much. These results, the first of this kind, were rather convincing. One of the major recommendations of the Gaither report was to build a nationwide fallout shelter system costing \$25 billion. Of course, it never happened.

Herman Kahn Arrives

I had not heard of Herman Kahn when he filed a visit clearance from the RAND Corporation in Santa Monica. He had traveled in different circles from mine. I don’t have a record of the date but I think he made the first of several visits in September or October 1957.

I had, of course, heard of the RAND Corporation. It was the Air Force’s think-tank and boasted the glitterati of military strategic thinkers, people like Bernard Brodie and Albert Wohlstetter. Herman was destined to outshine them all but when I first met him he was just a fat, moon-faced guy in his mid-thirties. Like me, he wasn’t even a Ph.D., just an ordinary person until he started to speak. He had a peculiar accent and pace to his talking that forced one to concentrate on what he was saying. (I later came to believe that he put that accent on because when chatting in the car, for example, he seemed to lose the accent.)

He came to see me because he was doing a study at RAND on civil defense and he had heard that I was doing some work that might apply. As we talked, I quickly became

intrigued with his approach to the subject. Looking back, I realize that I was being introduced to a strategic view of the world. My theory of survival was a tactical one: how to operate under nuclear attack to save lives and property. His approach was framed in national and global terms, as in his reference to Country A and Country B.

Country A, to Herman, was the 100 largest urban areas in the United States. When most people thought of America, said Herman, they thought mainly of Country A—and why not? Country A contained two-thirds of the population, 80 percent of the manufacturing, and most of the financial and service industries. But Country B, the rest of the country, was nothing to be sneezed at. After all, it had one-third of the population, 20 percent of the manufacturing capacity, and, moreover, it had virtually all of the agriculture and food production, and virtually all of the lumber, cement, iron ore, oil, and other resources needed for reconstruction. If Country A were destroyed in its entirety, Country B could survive and, according to Herman, could rebuild Country A in a generation. How is that for a theory of survival!

Over the next few months, Herman Kahn came to visit several times. Sometimes he brought one of his coworkers with him. One of these was Bob Panero, a young construction expert from the East, who had designed an underground city in the bedrock underlying Manhattan Island. He had done this “study”, of course, at Herman’s instigation. One of the few documents I have of this period is a cover letter from Herman dated May 2, 1958 forwarding three volumes of the Panero study of Manhattan Island shelters. In it, he writes:

“I am very interested in any comments you may have—about either the study as it was done or about possible changes for a future study of either New York or another city with self-supporting rock beneath it. The current shelters are actually pretty luxurious (400 cu. ft./person, lots of air conditioning, plumbing, etc.) and the next study should probably look at a very austere setup. In general, I think something like this type of study should be done both in more detail and for more cities—this, even though we are currently very far from recommending such a shelter system.”

Barry Bruce-Briggs, in his recent biography of Herman Kahn, has him first visiting me in late 1956 or early 1957. Despite his references to memoranda and interviews, I believe he was off by a year. I first met Herman after the Gaither summer study, not before. According to Bruce-Briggs, RAND set up Herman’s civil defense project in the fall of 1956, committing “about five man-years total, with a budget of just over \$100,000.” About 12 people were involved in the project, many of them part-time, so my judgment is that it was intended as a four- to six-month effort. Yet Herman’s Panero letter to me suggests that the study was still going on in May 1958.

On Herman’s first visit, he indicated that the project was just starting, so I believe the project was established in September 1957 and was intended to be finished in the spring of 1958. Again, according to Bruce-Briggs, “By early 1957, he [Herman] was the world’s leading expert on civil defense.” If so, how come Herman wasn’t on the Gaither Panel? Or a briefer to our passive defense group? Actually, Herman and Jane Kahn rented an

apartment in Washington during August 1957 while he, Wohlstetter, and other RAND luminaries briefed the evaluation group. The title of the Gaither Report is “Deterrence and Survival in the Nuclear Age” and much effort was spent on deterrence. The report gives its highest priority recommendation to hardening SAC bases, an area that Herman and Al Wohlstetter specialized in.

I think what happened was that Herman sat in on a briefing on the SRI computer assessment program for shelters and it aroused his interest. When he got back to RAND, he proposed to do a civil defense study. He may have voiced doubts about the value of shelters as put forward in the Gaither Report. That might explain why Frank Collbohm, president of RAND, a captive Air Force contractor, would approve the project. The Air Force was no friend of civil defense. But Herman became hooked on CD as many of us have and was drafting big shelter programs. In January 1958, when the project should have been concluding, Herman apparently briefed the RAND leadership on his conclusions. Frank Collbohm was horrified: “My main concern is the effect upon RAND in the future of having us identified with what can be considered an effort to put over a large-scale civilian defense program. . .should RAND be responsible for that? . .starting the big program. . .before any action has been taken to harden our deterrence force might be a very bad thing to do.”

And so Herman’s big CD program got rolled back. No formal report was ever published. A little pocket-sized document dated July 1, 1958 was eventually issued. It was titled, “Report on a Study of Nonmilitary Defense.” The report’s essence was made into an article, “How Many Can Be Saved?” that Herman published in the Bulletin of the Atomic Scientists in January 1959. The world’s greatest civil defense expert already had become interested in other things, including publishing his major opus, “On Thermonuclear War.”

The Theory of Survival at Sea

I have emphasized my work on the theory of survival of the civilian population because eventually that became my primary career. But during the 1950s I worked for the Navy and much of my effort was put to work on military problems, most of which are still classified Secret. There was one idea that I happened upon while working on a Navy study that is worth recording here.

The Navy has several “conditions of readiness” that have been developed over the years. One of these can be termed “wartime steaming.” This condition applies to the situation of just getting from one place to another when there is no indication that the enemy is nearby. It is different from peacetime steaming when there is no enemy. Some modest precautions are undertaken routinely, an additional lookout, perhaps one gun mount manned, that sort of thing. A higher condition of readiness might be termed “action anticipated,” or “action imminent.” Additional precautions would be undertaken, perhaps even “general quarters” in which the crew is in its combat posture and the ship is closed up to maximize watertight integrity. Finally, there is the situation of “enemy contact,” or “enemy engaged.”

What if radioactive fallout is encountered while in one of these readiness conditions? After all, fallout from megaton-yield thermonuclear weapons can be hazardous hundreds of miles from the site of detonation. What changes in readiness or operations should be promulgated for these situations?

The bad news was that the battle stations (gun mounts, flight decks, etc.) were topside and were vulnerable to fallout radiation. The good news was that most ships offered good radiation protection below decks. So the basic command decision was whether to fight the ship or seek shelter. It wasn't quite that simple and I was soon faced with a jumble of proposed changes that would not have been understandable, let alone be convincing. At last I stumbled on to a simple presentation that put structure into the decision process. I built a matrix formed by the classical conditions of readiness along one axis and the new threat of fallout radiation along the other, like this:

FIGHT THE SHIP	TAKE SHELTER	TAKE SHELTER	High Radiation Level
FIGHT THE SHIP	MINIMIZE TOPSIDE PERSONNEL	TAKE SHELTER	Low Radiation Level
FIGHT THE SHIP	NO CHANGE	NO CHANGE	No Fallout Radiation

Action
Imminent

Action
Anticipated

Wartime
Steaming

This approach made the recommendations understandable. I used each cell of the matrix as representing an operating situation that I could discuss in detail. Years later, I used this concept to invent the BOS system for civil defense.